A Dispensing Apparatus

The present invention relates to a dispensing apparatus particularly a multi-dose dispensing apparatus for dispensing metered quantities of fluid.

Conventional multi-dose dispensers have a metering chamber with a piston arranged therein. The metering chamber draws the fluid to be dispensed from a reservoir through a dip tube. The dip tube is connected to the base of the metering chamber via a one-way valve. When fluid is to be dispensed, the piston is depressed axially within the metering chamber to force the fluid from the chamber through an outlet. As pressure is applied to the fluid in the metering chamber the one-way valve which usually comprises a ball or rubber flap, seals the passage from the metering chamber to the dip tube. After the fluid has been dispensed, the piston is released and returns to its original rest position drawing more fluid from the reservoir, up the dip tube, through the one-way valve in the base of the metering chamber and into the metering chamber as it rises.

However, the one-way valves are known to be inefficient and contribute to variations in the shot weight dispensed. Furthermore, the shot weight dispensed by different dispensers is found to vary due to the tolerance stack-up of a number of mass-produced components which cause differences in the rest position of the pistons.

It is an object of the present invention to reduce variations in the shot weight of a multi-dose dispenser.

According to the present invention there is provided a hand-held multi-dose dispensing apparatus comprising

a metering chamber having an axis, an end portion at one axial end of the chamber and a side body portion extending from the axial end portion,

a piston arrangement movable with a piston stroke along the axis of the metering chamber with a seal portion of the piston arrangement being slidably engageable with a side portion of the metering chamber,

an inlet for fluid to enter the metering chamber, and

an outlet for fluid to be dispensed from the metering chamber,

wherein the inlet is provided on the side body portion of the metering chamber and, in use, during a first portion of the piston stroke the inlet is in fluid

communication with the metering chamber and during a second portion of the piston stroke the seal portion of the piston arrangement blocks the inlet preventing fluid from passing from the inlet into or out of the metering chamber.

The positioning of the inlet on the side portion of the metering chamber and the action of the piston to respectively provide fluid communication and block the inlet to the metering chamber during first and second portions of the piston stroke eliminates the need for a one-way valve, reducing costs and increasing reliability of the dispenser. Furthermore, since the volume of fluid dispensed is determined by the point at which the piston enters the second portion of it's stroke as it blocks off the inlet and prevents further fluid from entering the metering chamber, a more consistent volume of fluid is dispensed. This eliminates variations produced by tolerance stack-up of dispenser components causing the rest position of the piston and thus the shot weight to vary between dispensers.

A resilient member is preferably provided between the end portion of the metering chamber and the piston. The resilient member urges the piston into a rest position at the furthest point in its stroke from the end portion of the metering chamber. The resilient member may be an elastic member or a spring for example. When activating the dispensing apparatus, a user preferably pushes the piston from its rest position, through the first portion of its stroke to the second portion at which the inlet is blocked, preventing further fluid from entering the metering chamber. As the piston progresses further into the second portion of its stroke, fluid is forced out of the metering chamber through the outlet to be dispensed until the piston bottoms out. After the piston has bottomed out, the user releases the piston and the resilient member urges the piston back to its rest position. As the piston travels back through the second portion of its stroke with the inlet blocked, the pressure within the expanding metering chamber is reduced. When the piston reaches the first portion of it's stroke with the inlet in fluid communication with the metering chamber, fluid is sucked into the metering chamber by the reduced pressure therein and the piston is urged into its rest position by the resilient member ready for the next actuation.

The piston arrangement preferably comprises a first portion and a piston seal, the piston seal being arranged to slidably engage and seal against the inside surface of the metering chamber and to be moveable relative to the first portion of the piston

arrangement, such that during a second portion of the piston stroke when the pressure in the metering chamber exceeds a particular level, the first portion and the piston seal move relative to each other to open an outlet for fluid to be dispensed.

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a cross-sectional view of a dispensing apparatus with the piston in the rest position;

Figure 2 shows the cross-sectional view of the dispensing apparatus of Figure 1 with a piston arrangement blocking an inlet and

Figure 3 shows the cross-sectional view of the dispensing apparatus of Figure 1 with the piston arrangement in the bottomed out position.

Figure 1 shows a cross-sectional view of a dispensing apparatus 10 prior to actuation. The dispensing apparatus 10 has a metering chamber 20 with an axis 21, an end portion 22 at one end and a side body portion 23 extending therefrom surrounding the metering chamber 20. In this example, the side body portion 23 has a narrower section 24 adjacent the end portion 22 then a frusto-conical portion 25 leading to a wider section 26. However, the metering chamber could be any desired shape such as cylindrical for example.

The side body portion 23 has an inlet 27 formed therein. In use, the inlet 27 is connected via collar 28 to a dip tube to draw fluid to be dispensed from a reservoir (not shown). The reservoir could be any suitable container which is preferably, but need not be attached to the dispensing apparatus 10.

A piston arrangement 30 is provided inside the metering chamber 20. The piston arrangement comprises an insert rod 31 with an annular core 32 slid over a portion of its length. The core 32 rests on a first annular seat 33 extending out from the insert rod 31. The piston arrangement also has a piston seal 34 slid over the core 32. An outer surface of the piston seal 34 slidably engages and seals against the inside surface of the side body portion 23 of the metering chamber 20. The piston seal 34 rests on a second annular seat 35 which, like the first annular seat 33, also extends out from insert rod 31. A resilient member, in this example a spring 36, is provided between an annular seat 37 on the core 32 and the piston seal 34 to urge the piston seal 34 on to the annular seat 35 on the insert rod 31.

A further resilient member, in this example another spring 38, is provided between the end portion 22 of the metering chamber and an annular seat 39 on the underside of insert rod 31 to urge the piston arrangement 30 into the rest position shown in figure 1 with an annular projection 40 of the core 32 engaging a cap 50 provided on the metering chamber 20. An upper section of the core 32 extends through a circular aperture 51 provided in the cap 50.

An appropriate actuator (not shown) is attached to the upper section of the core which extends through the aperture 51 provided in the cap 50. The actuator will be adapted for the application to which the dispensing apparatus is to be put, such as a nasal dispenser or oral dispenser for example.

A ferrule 60 is provided attached to the cap 50. In use a container of fluid to be dispensed (not shown) may be attached to the ferrule 60 so that the metering chamber 20 is surrounded by the container and fluid to be dispensed may be drawn from the container up a dip tube (not shown) connected to the inlet 27.

Figure 2 shows the dispensing apparatus 10 beginning to be actuated with the upper section of the core 32 which extends out through the cap 50 being manually depressed by a user to push it towards the end portion 22 of the metering chamber 20. As a user depresses the core 32, the annular projection 40 disengages the cap 50 and the piston seal 34 slides downwards over the inside surface of the metering chamber to block the inlet 27 preventing further fluid from entering the metering chamber 20. Metering of the fluid commences once the piston seal 34 blocks the inlet 27 as it is pushed downwards. As the volume of fluid dispensed is controlled by only one dimension of the metering chamber 20, i.e. the bottom of the inlet 27 to the end portion 22 of the metering chamber 20, shot weight variance is significantly reduced.

As the core 32 is pushed further towards the end portion 22 of the metering chamber 20, the pressure within the metering chamber 20 increases. When the pressure within the metering chamber 20 overcomes the force generated by the spring 36 acting on the piston seal 34, the piston seal 34 unseats relative to the insert rod 31. In this example the pressure within the metering chamber 20 which causes the piston seal 34 to unseat relative to the insert rod 31 is set at a predetermined level by selection of a suitable spring 36. However, by selection of a suitable spring the piston seal 34 can be arranged to unseat relative to the insert rod 31 at any desired pressure within the

metering chamber 20. Fluid from the metering chamber 20 is forced through openings (not shown) exposed in the lower portion of the core 32 by the unseating of the seal 34 from the insert rod 31 and up through the core 32 to an outlet in the actuator.

Fluid continues to be dispensed as the core 32 is manually pressed further into the metering chamber 20 until the piston arrangement bottoms out. At this point a user stops pushing down the actuator and core 32 and the spring 38 pushes the piston arrangement 30 back up the metering chamber 20. As the piston arrangement 30 passes through this portion of its stroke, the piston seal 34 keeps the inlet 27 blocked and the pressure within the metering chamber 20 reduces as its volume expands. When the piston seal 34 rises such that the inlet 27 is in fluid communication with the metering chamber 20, the reduced pressure within the metering chamber 20 draws fluid from the reservoir and dip tube (not shown) into the metering chamber ready for the next actuation. The piston arrangement 30 is urged by spring 38 back into the rest position shown in Figure 1 with the annular projection 40 of the over moulded core 32 engaging the cap 50 ready for the next actuation.

The dispensing apparatus could be used to dispense any suitable fluid. However, the fluid is preferably a pharmaceutical product and may include, for example, a pure drug or a drug with a liquid and/or pharmaceutical acceptable excipient.

Many variations may be made to the example described above whilst still falling within the scope of the invention. For example the metering chamber 20 could be any suitable shape. Furthermore fluid could be passed out of the metering chamber through any suitable outlet. The dispensing apparatus is preferably made from a plastics material but could be made from any suitable material. Furthermore any closure system could be used to attach the dispensing apparatus to a container of fluid to be dispensed such as a screw-on or snap closure.